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(71) Applicants:
- **Zapparini, Giovanni**
  00185 Roma (IT)
- **Zapparini, Dario**
  00185 Roma (IT)

(72) Inventors:
- **Zapparini, Giovanni**
  00185 Roma (IT)
- **Zapparini, Dario**
  00185 Roma (IT)
- **Calia, Mario**
  00015 Monterotondo, Roma (IT)
- **Mingarelli, Enrico**
  Roma (IT)

(54) Silk screen printing on crystal/glass and transparencies of every sort, in a four-colour process, which makes translucent or transparent the printed image

(57) This system allows a four - colour printing on transparencies, that makes translucent or transparent the picture. The difficulties of such a printing are mainly three:

1) the use of mixtures (in well defined percentages) of the inks.
2) the drying process of the inks.
3) the removal of the fine dust from the support during the various phases of the working.

Solution for point 1: exact mixture of special inks.
Solution for point 2: right exposure in terms of time and electromagnetic frequency.
Solution for point 3: a) system with electromagnetic conduction; b) clean chamber; c) electrization of the materials in touch with the support; d) system of controlled suction; e) system obtained from incubators.

EP 0 778 154 A1

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Description

This technique comes in substance from that way of printing called "Silk-Screen Process," with characteristics and devices specifically studied (they will be discussed into detail later) that make possible a four-colour reproduction on a material usually refractory to this process of printing, the crystal/glass.

FOUR-COLOUR SILK-SCREEN PRINTING ON SUPPORTS OF SILICEOUS ORIGIN

The reason why a translucent four-colour silk-screen print on supports of siliceous origin has never been executed or rather it has been done in a not-translucent monochrome, can be deduced from the chemical-physical constitution of the printing-object support. The two main reasons for the difficulty of a four-colour silk-screen printing on these supports are:

1) The kind of inks used for the four-colour reproduction of pictures and photographs. For this kind of reproductions is necessary to use silk-screen chases or stencils made of natural (real silk cheesecloth gauze), synthetic (nylon and polyester) or metallic (stainless steel clothes) closely-woven materials. Therefore, the selection of inks and the method of drying them is fundamental to answer our purpose.
2) The electrostatic phenomenon during the printing phase on the supports of siliceous origin makes very difficult to obtain an optimal printing quality.

Crystal/glass is a very electrostatic material, this is the reason why it captures the fine dust which is in the air compromising the complete adhesion of the printing varnishes and consequently the printing quality, too.

There is no need to analyse in detail the silk-screen technique, which is already known and whose bibliography is at disposal; we intend to dwell upon the techniques adopted to resolve the two problems above listed:

1) For what concerns the inks, it is certain that they must possess, in a silkscreen process, not only a dense and finely ground pigment to pass through the links of the cliché material, but also some specific characteristics, which vary according to the material where they are going to be printed.

It is interesting to note that in the silkscreen process you must use a different kind of ink for every printing material, you cannot use the same ink to decorate polystyrene and to print on metal.

The silkscreen inks can be divided into four groups according to their drying-process and the way in which they tie themselves down to the ground material:

1A) Inks which dry up through the evaporation of solvents
1B) Inks which dry up through oxidization
1C) Inks which dry up through polymerization
1D) Inks which dry up through the action of U.V. rays

1A) Inks which dry up through the evaporation of solvents

In this group there is every ink with the property of attacking the material on which it is printed so that, when the solvent contained within itself is evaporated, the pigment remains incorporated to the material. These inks cannot be printed on materials with a basis of silicon.

1B) Inks which dry up through oxidization

Called oily inks, they are considered enamels. They are very resistant to scratches, they are very apt to be printed (i.e., they don't dry up in the finest parts of the stencil, even if a closely-woven material has been used), and they can maintain unchanged the tones of colours under the action of the atmospheric agents. They cannot be used for translucent prints.

1C) Inks which dry up through polymerization

These inks are used on every material which repelles printing, such as glass, ferrous and not-ferrous materials, that is, where there is an absolute need of adhesion. They are bicomponent inks (ink + catalyst). To polymerize, they need relatively long times of waiting, and they tend to change the shades of their colour or to lose it if exposed to the sunlight. Under the presence of the catalyst, they are not apt to be printed with closely-woven materials as those used in a four-coloured process.

1D) Inks which dry up through the action of U.V. rays

These inks dry up when the printed support passes into an oven which has a light source with ultraviolet rays. These inks have a great advantage, unlike the inks previously described: they are without solvents so that it is possible to print through stencils of very closely-woven materials without drying up in the finest parts. If they are employed on not-transparent printing supports, in a screen, it is possible to obtain the results which normal inks can hardly achieve.

If we consider all that has been said about the characteristics of the inks used for a silkscreen process it is clear the difficulty in obtaining a print on a cristal/glass which is:

1) Four-coloured
2) Translucent (transparent)
3) Exact in reproducing the tones of the original colours
4) Unalterable by the attack of the weather and the atmospheric agents

CONCLUSIONS

The result (see the registered model, table 1) has been obtained empirically using three groups of inks of the four above-cited, in the percentages we have described:

Table 1

Composition of the Compound of Inks-	
Ink which dries up through oxidization	from 10% to 17%
Ink which dries up through polymerization	from 5% to 9
Ink which dries up through the action of U.V. rays	from 70% to 90%

DRYING-PROCESS

A print made like that (using table 1's compound), on a support of siliceous origin, is directly or indirectly exposed to natural or artificial electromagnetical radiations in frequencies of 1 to 750 nm, in a controlled temperature, and for an exposition period of 1 to 10 seconds.

2) To diminish the electrostatical phenomenon, which causes the pressure of fine dust on the printing surface, we have adopted different solutions:

2A) The utilization of a system of conductors which, if electrified with opportune and continual tensions, make it possible to diminish the electrostatical phenomenon and consequently to eliminate the fine dust on the cristal/glass.
2B) The utilization of sterile rooms ("the clean room")
2C) The rubbing of the electrifiable materials brought into contact with the printing surface
2D) The utilization of a system of controlled suction set at a pre-defined distance on the printing surface
2E) Systems derived from incubator machines

Claims

1. Silk-Screen printing on crystal/glass and transparences of every sort, in a four-colour process, which makes translucent or transparent the printed image, characterized by the utilization of three groups of inks and by the utilization of a system which diminishes the electrostatical phenomenon and, therefore, partially eliminates the presence of fine dust on the cristal/glass.

2. Silk-Screen printing on crystal/glass and transparencies of every sort, in a four-colour process, which makes translucent or transparent the printed image, as in revendication 1, characterized by the utilization of the following groups of inks, in these percentages:

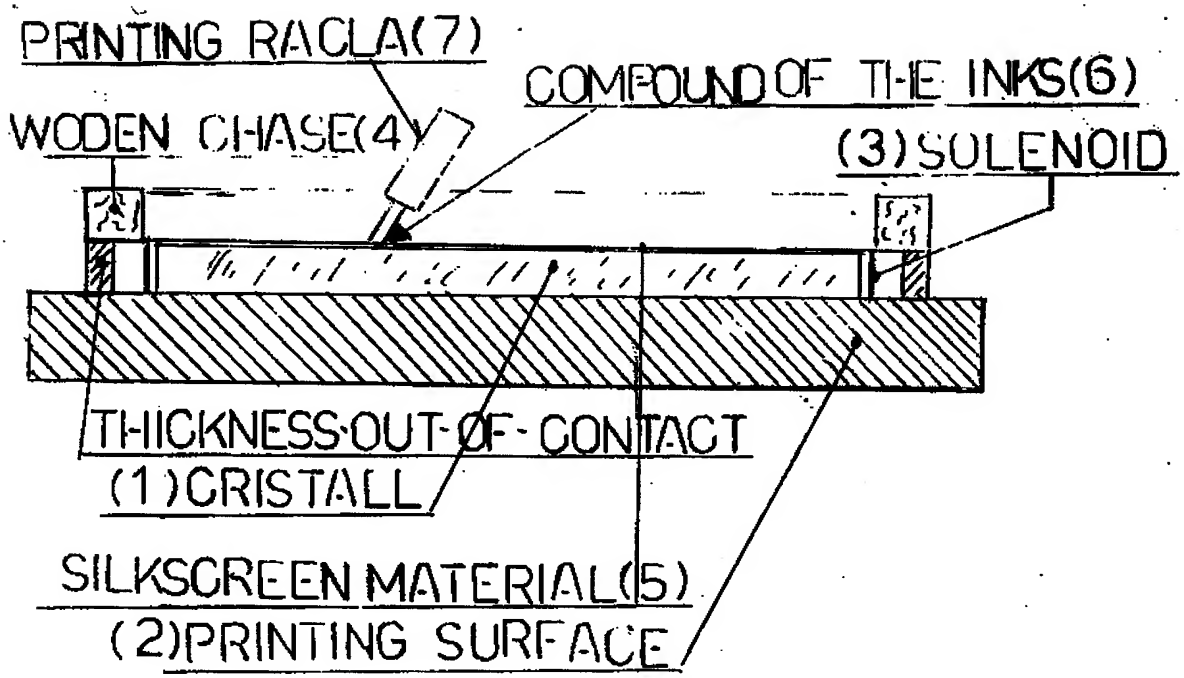
Ink which dries up through oxidization	from 10% to 17%
Ink which dries up through polymerization	from 5% to 9
Ink which dries up through the action of U.V. rays	from 70% to 90%

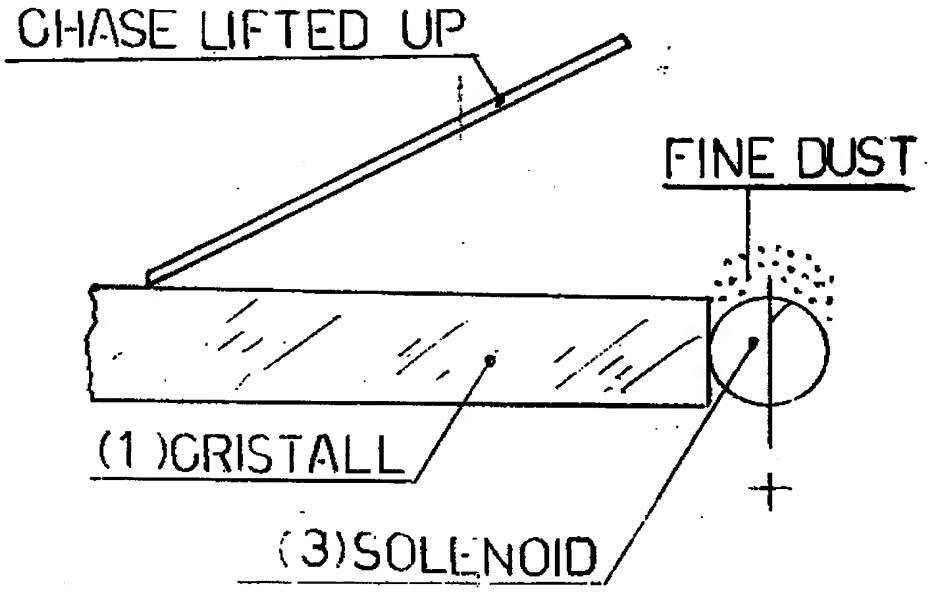
DRYING-PROCESS

A print made like that, using table 1's compound, on a support of siliceous origin, is directly or indirectly exposed to natural or artificial electromagnetical radiations in frequencies of 1 to 750 nm, in a controlled temperature, and for an exposition period of 1 to 10 seconds.

3. Silk-Screen printing on crystal/glass and transparencies of every sort, in a four-colour process, which makes translucent or transparent the printed image, as in the foregoing revendications, characterized by the utilization of a system of conductors which, if electrified with opportune and continual tensions, make it possible to diminish the electrostatical phenomenon and consequently to eliminate the fine dust on the cristal/glass
Alternative systems to eliminate the fine dust are:

3A) The utilization of sterile rooms ("the clean room")
3B) The rubbing of the electrifiable materials brought into contact with the printing surface
3C) The utilization of a system of controlled suction set at a pre-defined distance on the printing surface
3D) Systems derived from incubator machines


PRINTING RACLA(7)
COMPOUND OF THE INKS(6)
WODEN CHASE(4)
(3)SOLENOID
THICKNESS-OUT-OF-CONTACT
(1)CRISTALL
SILKSCREEN MATERIAL(5)
(2)PRINTING SURFACE


CHASE LIFTED UP
FINE DUST
(1)CRISTALL
(3)SOLENOID

TABLE(2)

TAVOLA -1-

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 83 0550

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	EP 0 308 389 A (NIJS GILBERT) 22 March 1989 * the whole document *	1	B41M1/34 B41M1/12
X Y	EP 0 338 284 A (ELTEX ELEKTROSTATIK GMBH) 25 October 1989 * the whole document *	3 1	
X	EP 0 256 153 A (MULLER HILMAR) 24 February 1988 * the whole document *	3	
X	LEITERPLATTENFERTIGUNG HEUTE. FERTIGUNG, QUALITAT, PROBLEME UND PROBLEMLOSUNGEN (PRINTED CIRCUIT BOARD MANUFACTURE TODAY. MANUFACTURE, QUALITY, PROBLEMS AND THEIR SOLUTIONS), BAD NAUHEIM, WEST GERMANY, 2-3 MAY 1983, no. 483, ISSN 0083-5560, VDI-BERICHTE, 1983, WEST GERMANY, pages 105-113, XP002025670 HUMMEL M: "Etched boards, choice of technology from the economic point of view, limitations and prospects" * the whole document *	3	
A	PATENT ABSTRACTS OF JAPAN vol. 011, no. 067 (M-566), 28 February 1987 & JP 61 225054 A (MATSUSHITA ELECTRIC IND CO LTD), 6 October 1986, * abstract *	1	
A	DE 23 26 306 A (ZUERCHER BEUTELTUCHFABRIK AG) 6 December 1973 * page 2, line 2 - line 8 *	32	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
B41M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	19 February 1997	Rasschaert, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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